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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention relates to the precision casting method by a lost wax process. This invention tends to improve fundamentally the fault of the low model used with a lost wax process by the resin model of a specific range.

[0002]

[Description of the Prior Art]The whole precision casting by the lost wax process as conventional technology is explained.

[0003]By slushing the low ingredient fused to the low model high production public-funds type with a lost wax process, and unmolding after cooling, Manufacture the low model of the same shape as casting products, and the surface of this low model is applied and hardened with refractories, It heats, the melting outflow of the low model is carried out, the mold which had burned thoroughly and was emasculated in high temperature firing is manufactured, teeming of the alloy fused to this mold is carried out, and it has a manufacturing process which breaks the mold after cooling solidification and takes out the casting.

[0004]If it explains in more detail, injection molding of this low ingredient will be carried out to a metallic mold, and a low model will be manufactured, but at this time, ejection temperature, injection pressure, injection pressure retention time, and cooling unmolding temperature are controlled, and the low model of fixed quality is produced. In this way, the manufactured low model is kept in the thermostatic chamber of constant temperature, and sufficient attention for maintenance of dimensional accuracy is paid. An assembly of this low model carries out low attachment of the low model at the gate model created separately, and is assembled by one. The assembled whole model is called the tree. Since the shape of this tree serves as a gating system casting plan as it is, in that design, many factors, such as a secility from the character of molten metal, cast size shape, a casting condition, and a tree, are taken into consideration.

[0005]In this way, the manufactured tree repeats immersion and desiccation to coating slurry, and it is coated with it in layers. The binders used for this coating slurry are colloidal silica, ethyl silicate, a hybrid, etc. Refractories impalpable powder is blended with these binders as a filler, and it becomes a slurry. In this way, a low model is immersed in the manufactured slurry, and an after-raising stucco grain is sprinkled and it dries. A JIRUKO side and a MOROKAITO grain are used for said stucco grain. Coating work is completed by repeating such operation several times.

[0006]Next, you make it a low model eluted from a mold at 120 to 150 °C in autoclave. This is called a delow. In order to remove the adhering carbon powder of a low or incomplete combustion and to raise the intensity of a mold, within the high-temperature-firing furnace of 700 to 1000 °C, for every stage, temperature up of the shell mold of this delow which finished is carried out, and it is calcinated. In this way, a melting alloy is cast by the manufactured mold, a mold is collapsed by an after-cooling KO machine, a casting is taken out, cutting removal of a runner, the cough, etc. is carried out, and adhesion remains refractories are removed in a blast. The part which can be repaired is repaired by welding, by a grinder, after finishing, is heat-treated and serves as a product of a foundry alloy.

[0007]the model used for the lost wax process mentioned above -- several kinds -- each -- research and development [ like ] have accomplished. First, as a low ingredient of the low model used as a model, the compound of a paraffin, rosin, carnauba wax, and terephthalic acid is common. About this low ingredient, details are indicated in the casting manual (Japanese cast association edit). These days, the validity of the low ingredient which blended the melamine granular material with the low ingredient is reported by JP,5-38549,A. Thus, since a low ingredient carries out elevated-temperature fusion and the characteristic which is easy to carry out a delow is held, as long as it is useful to use a low model and a low model is used as a destruction-by-fire model, there is a limit in raising the mechanical-strength physical properties of the model itself. The method which carried out lamination union of a synthetic resin and the low model is reported as a model. JP,5-23791,A indicates the model which made synthetic resin membrane form in the wax surface. JP,5-329174,A manufactures a \*\*\*\*\* model by heat melting resin, and indicates what was used as the model. JP,7-9084,A indicates the model which laminated the ROSUTO wax stand on the photo-setting resin sheet. JP,7-299542,A indicates further again the model which applied wax plastic material - to the embroidery model which consists of cotton yarn or a synthetic material. JP,7-47443,A inserts a photo-setting resin model and a heat dissolution resin lamination model in a metallic mold, and indicates the model which carried out injection molding of the ROSUTO wax. JP,2000-263186,A indicates the model which laminated the ROSUTO wax stand on the ultraviolet-curing-resin model. Thus, although a synthetic resin has come to be used for some or the whole of a model, this mainly aims at the improvement in shape retentivity of a low model, and

simple model construction. That is, it is the product to which digitization of the modeling construction method developed into and the application to modeling of photo-curing resin or thermoplastics progressed in connection with it.

[0008]There is JP,2000-210755,A which has advocated the precision casting which used the lost wax process by considering the model which uses a synthetic resin as low model substitution as what is most approximated to this invention. this manufactures a reaction-injection-molding thermosetting poly-urethan form model, and forms a shell mold in the surroundings of this model -- a heating process -- a model -- wax -- omission is carried out, a shell mold is stiffened and molten metal or a melting alloy is cast. This invention which advocates the precision casting using a lost wax process is fundamentally different, using foaming and the non-urethane foam model which uses a plasticizer and a low ingredient as an essential ingredient as low model substitution.

[0009]On the other hand, the material for manufacturing a resin model and the conventional technology of a construction method are explained. the conventional technology which manufactures a resin model -- a variety -- many -- it exists like. Foundations are construction methods which manufacture wood and the board stick of a plastic by cutting / adhesion processing. They are used by Howe's dry tree with good dimensional accuracy, and princess Komatsu in the wooden form industry which manufactures a casting model, being fond. In order to negate the directivity of wood at the time of model construction and to avoid distortion, the high-precision wooden form model is manufactured by variation per day by combining the directivity of wood with public.

[0010]In the design-model industry which manufactures a plastic pattern, board sticks, such as a bakelite acrylic, PP, and vinyl chloride, are manufactured by cutting / adhesion processing. The chemical wood excellent in the dimensional accuracy and machinability which hardened the micro resin balloon with urethane resin is used abundantly these days, The order of model shape is received not by a drawing but by data by rapid development of CAD/CAM, and it has come to manufacture the model of chemical wood by cutting chemical wood without directivity by NC machine.

[0011]The photo-setting resin was irradiated with the beam of light which received the order of and carried out computer control of the model shape by CAD data by one side, the resin curing disk of doughnut shape voice was manufactured, and the stereolithography which is accumulated one by one and used as a three-dimensional resin model has also spread. This stereolithography has the greatest feature in the point which can manufacture hollow three-dimensional shaping material without cutting.

[0012]Thus, one created precision model can be made into a master model, a plaster mold and a resin mold can be manufactured by gypsum-fibrosus reversal or resin reversal, and two or more resin models can be manufactured for liquefied resin with casting and making it

harden and reproducing a resin model to the mold. As liquefied resin for casting, urethane resin, an epoxy resin, unsaturated polyester resin, an acrylic resin, etc. are used. A resin material is chosen in consideration of the performance of the resin model demanded.

[0013] A resin model needs to be manufactured not by the above trial production model construction construction methods but by a mass production manufacture construction method, when a product needs to be manufactured so much. That is, it becomes an injection construction method which \*\*\*\* the thermoplastics which carried out melting to a metallic mold, and unmolds it after cooling solidification in high temperature high pressure. The RIM method stiffened while ejecting 2 liquid reactivity liquefied resin to a metallic mold and making a polymerization reaction cause inside a metallic mold is also a very leading construction method, and is already industrialized as a short-term mass production construction method.

[0014]

[Problem(s) to be Solved by the Invention] As mentioned above, when manufacturing a precision casting article with a lost wax process, the low model of a model which consists of a low ingredient is common. Although the feature said that this is excellent in the performance which it is easy to carry out the melting spill of the low ingredient at the time of an elevated temperature, and burns in a mold high-temperature-firing process is employed efficiently, The actual condition is having generated, also when a precision casting thing's comes to present complicated structure in recent years, and severe dimensional accuracy's is required and it cannot respond by a low model.

[0015] That is, by the closing-in part out of which, as for the technical problem about these low model, edge cannot come easily, in which a thin rib cannot stand easily and by which a thin rib breaks easily, the low model which must be unmolded with careful cautions at the time of unmolding and which has a thin part also out of 1 mm or less is that a technical limit exists in manufacture etc. It has a problem of being damaged in a dropping impact at the time of carrying with sweet dimensional accuracy which gets damaged easily since the manufactured low model has low surface hardness, and the low model created further has the problem that it must save in a thermostatic chamber in order to tend to cause a shape change on conditions summer. Careful cautions are required especially when moving a low model summer. A low ingredient is a comparatively low-molecular organic matter, and has the problem of softening at about 80 \*\*. Thus, the technical problem of a low model is concentrated on the technical problem resulting from a low ingredient. In order to improve the technical problem resulting from a low ingredient which was mentioned above, the improvement research by presentation change of a low ingredient is made, but. Although a low ingredient is a low melting point organic matter which dissolves at a temperature a little higher than ordinary temperature, since it has crystallized and solidified at ordinary temperature, the actual condition is not having resulted in solution of a fundamental technical problem.

[0016]The above thing to this invention persons are the resin models by which the fault improvement of a low model is promised, warming -- as a result of repeating research wholeheartedly about the resin composition for carrying out clear [ of melting spill performance, high-temperature-combustion performance, and the remains ash ], the resin model which consists of a resin liquid constituent within the limited limits found out that it was effective as low model substitution, and resulted in this invention.

[0017]

[Means for Solving the Problem]Therefore, in a destruction-by-fire resin model by which this invention is used for a lost wax process, Make 2 liquid reacting cure type urethane resin liquid (C) which comprises a polyfunctional polyol ingredient (A) and a polyfunctional polyisocyanate component (B) contain a plasticizer (D) one to 30% of the weight, and. Make a low wax component (E) contain one to 20% of the weight, and a resin liquid constituent is formed, and it is in stiffening this resin liquid constituent less than [ working life 5 minute ], and being formed (claim 1). Especially as working life, 1 to 2 minutes is preferred.

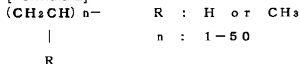
[0018]In said 2 liquid reacting cure type urethane resin liquid, said polyfunctional polyol ingredient (A) has 2.8 or more average functional group numbers, and. It is desirable for said polyfunctional polyisocyanate component (B) to have 2.0 or more average functional group numbers, and for NCO/OH to be 0.7-1.0 (claim 2).

[0019]When said 2 liquid reacting cure type urethane resin liquid (C) carries out reacting cure, it is desirable to carry out phase separation micro distribution of said plasticizer (D) (claim 3).

[0020]It is desirable for said 2 liquid reacting cure type urethane resin liquid (C) to contain a polyether chain shown by a chemical constitution formula which carries out the following two to 25% of the weight further again (claim 4).

[0021]

[Formula 2]



[0022]It is desirable for said low wax component (E) to be a size which fits in abbreviated 1-cm<sup>3</sup> which carried out a grain, the piece state of phosphorus, or massive (claim 5).

[0023]It is desirable to make said 2 liquid reacting cure type urethane resin liquid (C) contain moisture (F) 0.01 to 1.0% of the weight, and to carry out water foaming to it (claim 6), and it is desirable to make said 2 liquid reacting cure type urethane resin liquid (C) contain an organic solvent (G) ten to 25% of the weight (claim 7).

[0024]It is desirable to make said 2 liquid reacting cure type urethane resin liquid (C) contain the detailed piece (H) of naturally-occurring-polymers system waste 1 to 10% further again

(claim 8).

[0025]It is desirable to perform precision manufacture with a lost wax process using a destruction-by-fire resin model mentioned above.

[0026]

[Embodiment of the Invention]The ingredient combination composition of 2 liquid reacting cure type urethane resin liquid (C) used for this invention is explained first. The skeleton of 2 liquid reacting cure type urethane resin liquid (C) comprises 2 liquid of a polyfunctional polyol ingredient (A) and a polyfunctional polyisocyanate component (B), a chemical reaction is started by 2 liquid mixing at ordinary temperature, and exothermic hardening of it is carried out. the plasticizer (D) and the low wax component (E) which are contained in 2 liquid reacting cure type urethane resin liquid (C) -- a polyfunctional polyol ingredient (A) or a polyfunctional polyisocyanate component (B) -- it may be blended with either -- it carries out and may be blended with both. Moisture (F) is beforehand blended with a polyfunctional polyol ingredient (A) in hard [ slight / which is what causes a polyfunctional isocyanate component (B) and a chemical reaction ]. Natural cellulose system waste (H) is beforehand blended with a polyfunctional polyol ingredient (A) in order to cause a polyisocyanate component (B) and a chemical reaction. an organic solvent (G) -- a polyfunctional polyol ingredient (A) or a polyfunctional polyisocyanate component (B) -- it may be blended with either -- it carries out and may be blended with both.

[0027]Subsequently, each ingredient is explained.

[0028]As a polyfunctional polyol ingredient (A), there are low molecule polyol, polyether polyol, amine polyol, polyester polyol, acrylic polyol, polybutadiene polyol, etc., and castor oil and its derivative are used as a special thing.

[0029]As low molecule polyol, ethylene glycol propylene glycol, 1-4 butanediol glycerin trimethylolpropane pentaerythritol, etc. are mentioned.

[0030]As polyether polyol, the polyether polyol etc. of the various molecular weights which added ethyleneoxide and propylene oxide to the above-mentioned low molecule polyol are mentioned. As for polyether polyol, terminal hydroxyl groups will be the 1st class and the 2nd class with various addition method, such as ethyleneoxide independent addition, propylene oxide independent addition, mixed addition, and sequential addition. the reactivity of terminal hydroxyl groups changes with these, and an addition chain differs between hydrophilic nature and hydrophobicity by ethyleneoxide and propylene oxide -- several kinds -- each -- it becomes polyether polyol [ like ]. There is also polytetramethylene ether glycol obtained by the cationic polymerization of THF, and it is usually called PTMG.

[0031]With amine polyol, ethyleneoxide and propylene oxide are added to low molecule amine, such as ammonia ethylenediamine and polyethylene polyamine. It is the polyol which held the effect of an AMIMPO reel having contained the 3rd class nitrogen in intramolecular by this, and

promoting the reactivity of an isocyanate. The amine polyols which used ammonia as the starter are three organic functions, and the amine polyols which used ethylenediamine as the starter are four organic functions, and if polyethylene polyamine is used as a starter, they will serve as four or more organic functions many organic functions. These are ingredients indispensable to this invention which performs flash set.

[0032]As polyester polyol, there is condensed type polyester polyol which used the molecular terminal as the hydroxyl group by esterification about dibasic acid and low molecule polyol. the kind of dibasic acid and low molecule dioltriol -- selection adjustment, adjustment of a molecular weight, small-quantity use of polyfunctional low molecule polyol, etc. -- a variety -- many -- it becomes polyester polyol [ like ]. As dibasic acid used for condensed type polyester polyol, adipic acid is used abundantly. As low molecule diol, they are glycerin, trimethylolpropane, those alkylene oxide low additions, etc. as triol, such as ethylene glycol, propylene glycol, and 1,4 butanediol. the ring-opening-polymerization type polyester polyol of epsilon caprolactam -- if it carries out, a functional group number and a molecular weight are adjusted by adjusting the kind and the amount of the ring-opening-polymerization initiator used. By adding alkylene oxide to these, there are some which also have a thing with a polyester chain and a polyether chain, and have method nature of Oshi dramatically. There is also so-called carbonate diol obtained in the ring breakage of ethylene carbonate.

[0033]Acrylic polyol is the acrylic oligomer which polymerized the acrylic monomer which contains terminal hydroxyl groups in methyl acrylate or a methylmetaacrylate, and had two or more hydroxyl groups in the acrylic chain. Various kinds of acrylic polyol formed by choosing the kind of acrylic monomer and adjusting a molecular weight is already marketed. Slight bridge construction is performed by aliphatic series polyisocyanate, and the resin liquid which even the level which carries out film formation raised and polymers-ized the degree of polymerization, and was dissolved in the organic solvent serves as a paint excellent in weatherability.

[0034]Polybutadiene polyol is copolymer of the butadiene which contains a hydroxyl group at the end, and the compound which has a double bond. It is hydrophobic, strong polyol comparatively.

[0035]It is good also as urethane-ized denaturation polyol which carried out the joint of such polyfunctional polyols by polyisocyanate, and was used as terminal hydroxyl groups. In this case, since it is oligomerized by urethane-ized denaturation and a molecular weight becomes a little large, the tendency which viscosity increases is strong. Therefore, it is preferred to make a part of polyfunctional polyol into urethane-ized denaturation polyol.

[0036]Single use of such polyfunctional polyols may be carried out, and they may carry out mixed use of the two or more sorts. Generally, in order to fulfill many request items over the purpose, a molecular structure design accomplishes by carrying out initial-complement mixing

use of various kinds of polyfunctional polyol ingredients. These polyfunctional polyol ingredients (A) have an activity hydroxyl group in a molecular terminal, and reactivity with an isocyanate changes with kinds of hydroxyl group of a molecular terminal.

[0037] Especially polyether polyol and polyester polyol contain a small amount of moisture strongly [ compatibility with moisture ]. When using this minute amount moisture with water foaming urethane, there is no inconvenience in any way. However, to consider it as non-urethane foam, it is required to carry out reduction control of a little moisture contents firmly. Therefore, a polyfunctional polyol ingredient (A) is produced through a heating mixing dehydration process.

[0038] A polyfunctional polyisocyanate component (B) is a compound which contains two or more isocyanate groups in one molecule, and a polyol ingredient contains two or more hydroxyl groups in one molecule. An isocyanate group is a functional group which was dramatically rich in reactivity, and reacts to a hydroxyl group, an amino group, and a thiol group with active hydrogen. In order to react to an amino group or a thiol group momentarily, limited adaptation is carried out at aromatic amine lacking in an isocyanate component and reactivity lacking in reactivity etc., but the combination is not used abundantly in order to still react early too much.

[0039] As a polyisocyanate component, there are aromatic polyisocyanate, aliphatic series polyisocyanate, and alicycle fellows polyisocyanate. As aromatic polyisocyanate, tolylene diisocyanate and diphenylmethane diisocyanate are typical. Tolylene diisocyanate is obtained as a mixture of various isomers on the chemical reaction at the time of manufacture, and industrially, TDI-100 (2, 4-TDI 100%), TDI-80 (2, 4-TDI 80%, 6-TDI 20%), and TDI-65 (2, 4-TDI 65%, 6-TDI 35%) are marketed by the mixture ratio of 2 and 4-object and 2 and 6-object. diphenylmethane diisocyanate -- said -- it is obtained as a mixture of various isomers on the chemical reaction at the time of manufacture like, and there are pure MDI and a polymeric MDI industrially. Pure MDI is a dicarboxylic acid, a polymeric MDI is coenocytic, pure MDI isolates by distillation and a polymeric MDI remains as a still residue. Since the numbers of coenocytic differ on manufacturing conditions, this polymeric MDI has various kinds of polymeric MDIs, and it is marketed from each maker. Naphthalene diisocyanate and toluene diisocyanate which gave the isocyanate group are mentioned to a naphthalene core. As aliphatic series polyisocyanate, hexamethylene diisocyanate, isophorone diisocyanate, xylylene diisocyanate, and lysine diisocyanate are mentioned. The hydrogenation MDI which carried out hydrogenation of the hydrogenation xylylene diisocyanate which carried out hydrogenation of the xylylene diisocyanate, or MDI as alicycle fellows polyisocyanate is mentioned.

[0040] Since toxicity is strong, it is used for various conversion by the polyisocyanate which has especially volatility since polyisocyanate is generally rich in reactivity, giving. This includes urethane denaturation, dimerization, 3 quantification, the formation of poly rib diimide, urea

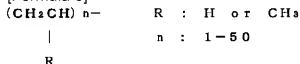
denaturation, prepolymer-izing, blocking, etc. Self-condensation of these is carried out using the high reactivity of an isocyanate group, or joint is carried out via an active ingredient, and they leave an isocyanate group to an end.

[0041]The specific range on this invention about 2 liquid reacting cure type urethane resin liquid (C) which uses a polyfunctional polyol ingredient (A) and a polyfunctional polyisocyanate component (B) as a resinous principle is explained.

[0042]2 liquid reacting cure type urethane resin liquid (C) which uses a polyfunctional polyol ingredient (A) and a polyfunctional polyisocyanate component (B) as a resinous principle contains the polyether chain shown with the following chemical constitution formula two to 20% of the weight.

[0043]

[Formula 3]



[0044]When polyether is used for a polyfunctional polyol ingredient (A), it means that the polyether chain was introduced. If it is ester of polyether when using polyester polyol, it will mean that the polyether chain was introduced. If a polyfunctional polyisocyanate component (B) is the prepolymer of an end isocyanate and \*\*\*\*\* quasi by which joint was carried out by polyether, it will mean introducing a polyether chain. This polyether chain is a soft ingredient of urethane resin, and especially the polyether chain derived from propylene oxide is dramatically soft. When heated by the elevated temperature in a delow and a baking process, saying that it is very soft causes a pyrolysis, and it has in the pyrolysis the character which is easy to carry out liquefaction outflow combustion. In this invention, this characteristic is skillfully demonstrated by making a polyether chain contain two to 25% of the weight. If content of a polyether chain goes down 2 % of the weight, this effect will carry out attenuation disappearance. If content of a polyether chain will be 20% of the weight or more, a soft ingredient will increase too much and a hardened material will become soft, and it becomes impossible to save the hardness required of a model. Therefore, the content of a more desirable polyether chain is 5 to 20 % of the weight.

[0045]Loadings of a polyfunctional polyol ingredient (A) and a polyfunctional polyisocyanate component (B) calculate the number of NCO groups, and the number of OH radicals, and in the case of non-urethane foam, it is usually designed so that ratio NCO/OH of the number of NCO groups and the number of OH radicals may become the 1.0 neighborhoods. In the case of urethane foam, NCO/OH is designed in about 1.0 to 1.1 overisocyanate field. The number of an isocyanate group and hydroxyl groups is the same number, and NCO/OH=1.0 is a design which a reaction ends exactly. That is, it is a field which reveals the highest intensity. In this

invention, it is set to  $\text{NCO}/\text{OH}=0.7 - 1.0$  in a NCO insufficient field. Usually, a molecular design of urethane is not performed in such a NCO insufficient field. A reason for the ability to perform a molecular design by this invention in such a NCO/OH field that can be referred to as unusual, it is because NCO/OH can take the three-dimensional network structure also in 1.0 or less field by making 2.1 or more and an average functional group number of a polyol ingredient into 3.0 or more and many organic functions for an average functional group number of a polyisocyanate component. Although a shortage of an NCO group and an OH radical of this state are superfluous, it is because connection of a monomer is completed and a main chain can be constituted, even if there is no full reaction of a functional group, since a use monomer serves as many organic functions. An OH radical without a superfluous reactional phase hand ends a reaction, where an OH radical is held in a main chain. For this reason, a keeping of hydrophilic nature increases and it is thought that phase separation micro distribution of the hydrophobic, strong plasticizer can be carried out now as a result.

[0046]this --  $\text{NCO}/\text{OH}=0.7-1.0$  -- it is 0.8-0.9 preferably. It becomes so soft that it will be in a large insufficient state of an isocyanate group, and it will become impossible to take the after [ reacting cure ] three-dimensional network structure, a hardness fall will be caused extremely and shape maintenance will become difficult finally, if NCO/OH becomes 0.7 or less. On the other hand, if NCO/OH becomes 1.0 or more, an isocyanate group will become superfluous, even if unmolding time comes, an unreacted isocyanate group remains, and if predetermined hardness does not come out or an irregular color occurs on the hardened material surface, that phenomenon which is not preferred will occur.

[0047]There are a metal catalyst and an amine catalyst as a catalyst which promotes a chemical reaction of a polyfunctional polyol ingredient (A) and a polyfunctional polyisocyanate component (B). As a metal catalyst, octylic acid zinc and lead octylate, dibutyltin dilaurate, Djibouti rutin diacetate, etc. are mentioned. Triethylenediamine, NN-dimethylpiperazine, N-methylmorpholine, etc. are mentioned as an amine catalyst. These catalysts are usually added in a polyol ingredient. Usually, 1-1000 ppm is added by polyfunctional polyol ingredient (A), and working life is adjusted. In this invention, addition use of the catalyst is carried out at a polyfunctional polyol ingredient (A) so that available time, i.e., working life, may be less than 5 minutes. When working life becomes 5 minutes or more, hardening unmolding time turns into 5 hours or more, and resin model construction top trouble will be caused. When working life is 1 or less minute, a reaction viscosity rise is hard coming to take 2 liquid mixing and casting working hours early. Therefore, working life's 1 to 2 minutes are preferred.

[0048]Subsequently, a plasticizer (D) used for this invention is explained.

[0049]A plasticizer (D) used for this invention is liquefied at a room temperature with a compound which inertness volatility without a functional group which causes a chemical reaction can disregard. As this plasticizer (D), an ester system plasticizer, an ether system

plasticizer, and an ester ether system plasticizer are mentioned. Concretely, as an ester system plasticizer, dioctyl adipate (DOA), dioctyl phthalate (DOP), and dibutyl phthalate (DBP) are typical. In addition, benzyl acetate, benzoic acid butyl, benzoic acid octyl, isopentyl benzoate, Ethylene glycol benzoic acid diester, polyethylene-glycol benzoic acid diester, Propylene glycol benzoic acid diester, polypropylene-glycol benzoic acid diester, ethylene glycol JIORIETO, polyethylene-glycol JIORIETO, propylene glycol JIORIETO, polypropylene-glycol JIORIETO, etc. are mentioned. As an ether system plasticizer, ethylene glycol dibutyl ether, Ethylene glycol diphenyl ether, diethylene glycol dimethyl ether, Diethylene-glycol methyl ethyl ether, diethylene-glycol diethylether, Diethylene-glycol ethylbutyl ether, diethylene-glycol dibutyl ether, Triethylene glycol wood ether, triethylene glycol wood ether, triethylene glycol diethylether and fatty tuna -- ethylene glycol dibutyl ether, tetraethylene glycol wood ether, tetraethylene glycol diethylether, etc. are mentioned. As an ether ester system, ethylene-glycol-monobutyl-ether acetate, diethylene glycol monoethyl ether acetate, diethylene glycol monobutyl ether acetate, JIECHITENGURIKORU monophenyl ether acetate, etc. are mentioned.

[0050]The amount of said plasticizer (D) used is 2 to 20 % of the weight to 2 liquid reacting cure type urethane resin liquid (C). If the amount of plasticizer (D) used makes it high-contain to 20% of the weight or more, a plasticizer (D) will carry out bleeding to the surface of a resin model, and it will be generated by smeariness tuck. If the amount of plasticizer (D) used will be 2 or less % of the weight, it will become difficult to flow out by delow and a baking process at the time of resin pyrolysis melting spill combustion. Although a plasticizer (D) is a fluid with high viscosity at a room temperature, it is because it becomes the hypoviscosity which flows out easily at an elevated temperature. In order to demonstrate strongly an effect said like this, he wants to make a plasticizer (D) high-contained as much as possible. Usually, if many plasticizers are included in a resinous principle, as mentioned above, a plasticizer will carry out bleeding to the hardened material surface, and a tuck and smeariness will be generated on the surface. Then, a result of having inquired wholeheartedly in order to make a plasticizer (D) high-containing as much as possible, Flash set was carried out less than [ working life 5 minute ], a plasticizer (D) carried out phase separation from hardening resin, and it found out that it was effective to change into the state where it is shut up in a micro dispersion state in the three-dimensional network structure of hardening resin, and resulted in this invention.

[0051]Such a phase separation micro decentralized structure can be expressed as it is in a state where a plasticizer (D) is included in hardening resin of the shape of a nest of a bee. a swage block -- hardening resin of \*\* is a structure excellent in strength properties -- a plasticizer (D) -- a swage block -- it can save carefully inside and it can be said that it is a spacial configuration which is not emitted to the exterior. By this, even if a plasticizer (D) serves as high content comparatively, it is oozed and used as the hardened material surface,

and does not cause tuck generating. When not taking a phase separation micro decentralized structure, if it will dissolve into hardening resin and becomes beyond saturation, a plasticizer will be oozed and used as the hardened material surface, a tuck will come out, a plasticizer oozes, and if there is much \*\*, it will become easy to generate smeariness. Such a phase separation micro decentralized structure is checked by an electron microscope. It is required to carry out flash set less than [ working life 5 minute ] for supporting a phase separation micro decentralized structure. It is less than 3 minutes preferably, and is 1 to 2 minutes especially. If working life becomes 5 minutes or more, it will become difficult to complete phase separation micro distribution, and one day or more will be needed for unmolding at the time of model construction, and quick-on model construction nature will be lost.

[0052] In a stage which the state where the uniform dissolution was carried out is required for it when a plasticizer (D) exists as 2 liquid reacting cure type resin liquid (C), and carries out reacting cure, phase separation micro distribution is supported from hardening resin, a plasticizer which carried out micro distribution at the reacting cure conclusion time is included, and bleeding to the surface is barred. A presentation is constituted on delicate balance said like this. That is, hydrophilic nature and hydrophobic balance of a plasticizer (D) and reacting cure nature resin need to be designed to a field adjusted well. For this reason, as a hydrophilic segment, an alkylene oxide chain is effective and a hydrocarbon chain is effective as a hydrophobic segment. These hydrophilic segments and hydrophobic segments are determined by selection of a raw material monomer to be used. Balance of such hydrophilic nature and hydrophobicity needs a design made to deviate to some extent. If an ethyleneoxide chain is used abundantly to 2 liquid reacting cure type resin liquid (C), hydrophilic nature will become strong, and if a propylene oxide chain is used, rather than an ethyleneoxide chain, hydrophilic nature will become weaker. If an ethyleneoxide chain and a propylene oxide chain are lessened, hydrophobicity will serve as strong 2 liquid reacting cure type resin liquid (C). By adjusting these, hydrophilic nature and hydrophobicity can be adjusted now by a certain within the limits. A plasticizer's (D) own hydrophilic nature and hydrophobicity can be adjusted now by a certain within the limits by adjusting a kind and the amount of plasticizer (D) used. For example, when making an end into alkyl ether, hydrophobicity becomes large as it changes with methyl ether ethyl ether butyl ether phenyl ether. Thus, an area range which changes and carries out phase separation micro distribution of chemical structure of a plasticizer (D), chemical structure of the amount used and 2 liquid reacting cure nature resin liquid (B), and the amount used is set up. If a resinous principle is set up by such a method so that hydrophilic nature may become strong comparatively so that hydrophobicity may become strong comparatively about a plasticizer (D) and, phase separation micro distribution will be materialized well.

[0053] Subsequently, a low wax component (E) used for this invention is explained.

[0054] A low wax component is a compound which inertness volatility without a functional group which causes a chemical reaction can disregard, and is an existing crystalline solid at a room temperature. There is a synthetic wax obtained as a low wax component (E) by a natural low and composition which exist naturally. There is a candle in which we exist close as a natural low. Chemical composition of a natural low ingredient is ester which comprises higher fatty acid and higher alcohol, and is called low ester. As for a carbon number of higher fatty acid and higher alcohol, 16 or more are a subject. Since it is an ester compound, acid value remains somewhat. That is, free fatty acid remains. Since much saturation and unsaturation higher fatty acid exist naturally, depending on a low, high-class unsaturated fatty acid and hydroxy acid will also be contained. These lows are the chemical structure near a paraffin, it is crystallization or the solid made amorphous at ordinary temperature, and the melting point is generally around 80 °C. When a typical low is mentioned, a candelilla low, Kalna Barrow, a rice wax, A dense low, spermaceti wax, montan wax, a lanolin ROUORI curie wax, an alpha wax, a cork textiles wax, a sugarcane wax, haze wax, a sault Mac low, a micro loris thalline wax, ozokerite, etc. are mentioned. A wax obtained by polyethylene wax and Fisher-Tropsch composition as a synthetic wax, A wax, silicon wax, a fluoride content wax which are obtained by catalyst hydrogenation of nature copolymers of a low and those ester, animals and plants that have a fat chain of straight chain shape or a letter of branching by C8-C32, or an alimentary oil are mentioned. These low wax components may be independent, or a low ingredient and a wax component by which were mixed and a third component was added may be sufficient as them. Character as a paraffin or an olefin is strong, hydrophobicity is dramatically strong, and this low wax component (E) is a solid at ordinary temperature. Therefore, it has the character which is hard to dissolve in a polyfunctional polyol ingredient (A), a polyfunctional polyisocyanate component (B), and a plasticizer (D). Therefore, even if blended with 2 liquid reacting cure genotype urethane resin liquid (C), it is hard to dissolve, and it is in the state where it is floating in a system in liquid. In such a state, 2 liquid reacting cure type urethane resin liquid (C) will carry out flash set, and will be included as a solid in resin of the three-dimensional network structure as a result. Therefore, since a low wax component is not directly exposed to the surface, a resin model of this invention has the feature referred to as that a fault of a low model is avoided entirely. This low wax component (E) has a large effect of flowing out and accelerating a resin decomposition product which carried out "softening, a pyrolysis, and melting" in a delow and a baking process by heating. [0055] This low wax component (E) is used one to 20% of the weight to 2 liquid reacting cure type urethane resin liquid (C). When the amount used is 1 or less % of the weight, the delow effect by using a low wax component (E) is extinguished. If it changes to 20% of the weight or more, the mobility of 2 liquid reacting cure type resin liquid (C) will worsen, and workability at the time of resin model construction will be spoiled. Intensity of a resin model itself falls and a

possibility of it being divided at the time of unmolding, or breaking becomes high. Therefore, it is 5 to 20 % of the weight preferably, and is 10 to 15 % of the weight more preferably.

[0056] This low wax component (E) is [ which fit in a cube of  $1\text{ cm}^3$  / particle state, the shape of a scale, and massive ]. Particle state and massive one may be ball-like - or the shape of lump sugar, and the shape that transformed some. That is, it is restricted to neither Matama nor an honest square pillar. A size is also a size settled in a cube of  $1\text{-cm}^3$ . Preferably, it is below 1 mm (abbreviated  $0.8\text{-mm}^3$ ) in diameter. Naturally this low ingredient becomes difficult to flow into the closing-in portion of 1 mm or less of a model. therefore -- although uniform distribution of a low wax component (E) in a model will be spoiled -- shape retentivity as a model, dimensional accuracy, and warming -- there is little combustion decomposition remains ash at the time of the incongruent melting excurrent at the time and an elevated temperature, and what is necessary is just to be able to carry out mold manufacture and precision casting. Naturally this low ingredient flows into the thickness part of 1 mm or more of a model easily. It will be said that uncured resin liquid also flows in easily, a model could unmold from a mold as a result, and a resinous principle has just spread round the whole model. It is convenient in a sense that many low wax components (E) flow into a thickness part of a model. That is, a thickness part tends to be in melting outflow decomposing combustion in a delow and a baking process. When comparatively many low wax components (E) flow into this part and it is fixed with hardening resin, in a delow and a baking process, an effect which supports melting outflow decomposing combustion well will be revealed greatly.

[0057] Subsequently, water (F) used for this invention is explained.

[0058] Moisture (F) is  $\text{H}_2\text{O}$ . With moisture (F), there is moisture which moisture blended with \*\* intention target, minute amount moisture mixed in \*\* usual chemicals article raw material on a manufacturing process, and the \*\* raw material itself absorb out of the air. Moisture (F) as used in the field of [ here ] this invention contains all for these. A reason for using moisture (F) uses the carbon dioxide emitted by a chemical reaction with polyfunctional polyisocyanate as a foaming agent, is got blocked, and introduces water foaming art of urethane. As a result, a resin model is accomplished with foam which included a plasticizer (D), and a low wax component (E) and air bubbles. By this, such a resin model itself that is foam maintains firm shape retentivity, and it reveals big validity to thermofusion decomposition outflow combustion in a delow and a baking process at limited within the limits which adjusted foaming.

[0059] Principal divisor which determines expansion ratio is the quantity of moisture (F), and subfactors are temperature, humidity, etc. of the water of adsorption and the open air of a molding surface. Quantity of moisture (F) is contained 0.01 to 1.0% of the weight to 2 liquid reacting cure type urethane resin liquid (C). Preferably, it is 0.03 to 0.5 % of the weight. It is 0.08 to 0.15 % of the weight more preferably. If moisture (F) will be 1.0% of the weight or

more, air bubbles will carry out abundant concentration on the resin surface, a skin on the surface of a model will become thin, and a skin is destroyed at the time of unmolding, and air bubbles will appear on the model surface in concave voice, and will become inconvenient [ the model surface ]. That is, to control on a fine foaming level is required. In urethane foam, in order to arrange a size of air bubbles, a foam stabilizer is used. Though natural also in this invention, it is important to add a foam stabilizer and to arrange a size of air bubbles.

[0060]Moisture (F) is usually blended with a polyfunctional polyol ingredient (A). This polyfunctional polyol ingredient (A) blends and mixes water homogenously, and is controlled by performing a little water measurement by the Karl Fischer's method. If abnormalities in a model construction top are not caused of an ingredient only with sufficient water which carries out and contains water when blending with a polyfunctional polyol ingredient (A), there will be no restriction in particular. For example, surface-active agent solution, a dye solution, an aqueous paste, resin solution, etc. are mentioned.

[0061]Surface-active agent solution is solution of an anionic surfactant, a cationic surfactant, a nonionic surface active agent, an amphiphilic surface active agent, or a polymer surfactant. However, \*\* are not limited in particular for the aqueous solution concentration. That is, liquid detergents and moisture having contained many moisture are a solid detergent and powder detergent few. These addition methods are blended with a polyfunctional polyol ingredient (A). The uniform dissolution of this may be carried out at a polyfunctional polyol ingredient (A), and it may be a distributed floating state.

[0062]A surface-active agent consists of a hydrophobic radical which generally consists of long chain alkyl groups, and a hydrophilic radical which is easy to dissolve in water. It seems that orientation of the surface-active agent is carried out to a strong text of such hydrophobicity since a hydrophobic, strong plasticizer component (D) and a low wax component (E) exist in a combination system.

[0063]A dye solution is solution of a color with a hydrophilic radical, and an aqueous paste is a kind of polymer surfactant, and is a cellulose type polymer aqueous solution.

[0064]Resin solution is solution of strong resin of hydrophilic nature, and vinyl acetate, EVA, etc. are typical.

[0065]In this way, when carrying out water foaming, a foam stabilizer is used in order to arrange a size of air bubbles as much as possible. A foam stabilizer is a kind of surface-active agent, and a type to which silicon was made to add alkylene oxide is common. By adding and carrying out water foaming of the foam stabilizer, foam by which it is dotted with air bubbles of a size comparable comparatively uniformly in a model can be obtained. In this case, although intensity of a model falls, a big predominance is revealed in order that a delow ingredient and a calcination ingredient may decrease substantially in a delow process and a baking process. It is because intensity of a model does not necessarily have a severe demand and intensity of a

grade which can be unmolded smoothly is enough at the time of model unmolding. A level which is equal to carrying may be sufficient as intensity of a model after unmolding. A shape change should just be very small at the time of ordinary temperature storage. Intensity which is equal to coating work should just be held further again at the time of fire-resistant coating. Since it does not ask for high intensity from the above thing, a resin model of this invention which included a plasticizer and a low wax component is enough.

[0066]Subsequently, an organic solvent (G) used for this invention is explained.

[0067]As an organic solvent (G), an inertness organic solvent which does not carry out an isocyanate and a chemical reaction is chosen. As an inertness organic solvent, there are an aromatic system organic solvent, an ester system organic solvent, an ether system organic solvent, an aliphatic series system organic solvent, a chlorine-based organic solvent, etc. As performance required of an organic solvent (G), dissolving polyfunctional polyether (A), polyfunctional polyisocyanate (B), and a plasticizer (D), that a bad smell is mild, not generating poisonous gas at the time of combustion, and economical efficiency are \*\*\*\*\*s. As for an organic solvent (G) which fills such a military requirement, being selected from an aromatic system organic solvent is preferred, for example, they are toluene and xylene.

[0068]It is effective in 2 liquid reacting cure type resin liquid (C) supporting a foaming agent role by an organic solvent (G) becoming a gas easily in an exothermic gelling stage. Inside a model after hardening unmolding, an organic solvent (G) is in the state where some were shut up. An effect which an organic solvent (G) rather remains inside a thick part in a part with a thickness of 1 mm or more which does not burn easily, and supports combustion at the time of a delow and a sintering process is large. An effect of falling resin viscosity and making workability on model construction improving is dramatically large.

[0069]Subsequently, a detailed piece (H) of naturally-occurring-polymers system waste used for this invention is explained.

[0070]A detailed piece (H) of naturally-occurring-polymers system waste is a detailed piece of waste of waste and textiles clothing of the waste and wood of papers, etc. As a detailed piece of waste of papers, detailed pieces, such as a newspaper, an advertisement paper, a clerical work copy paper, packing paper, and a corrugated fiberboard, are mentioned. As a detailed piece of waste of wood, dry grass of structural waste wood, and the waste wood, the furniture scrap wood, between wood and vegetation for engineering works, a detailed piece of chaff, etc. are mentioned. As waste of textiles clothing, a detailed piece of cotton clothing, Mai, and wool clothing is mentioned. If an example is given in detail, papers will be what cut and carried out minuteness making of the office paper used and thrown away by a shredder, and the textiles waste by which crushing cutting was carried out at the shape of a single fiber when wood was sawdust and textiles clothing which will be produced in demolition, grinding, and cutting if it becomes, if it becomes. Even various shaped objects 1 mm or less in length have

that preferred by which minuteness making was carried out.

[0071]As for a detailed piece (H) of these naturally-occurring-polymers system waste, being blended with a polyfunctional polyol ingredient (A) is preferred. Since specific gravity of a detailed piece (H) of naturally-occurring-polymers system waste is approximated to specific gravity of a polyfunctional polyol ingredient (A), when sedimentation and surfacing will float in liquid of a detailed piece (H) of naturally-occurring-polymers system waste few and is mixed, it is easy to carry out uniform dispersion comparatively. If it deaerates by a reduced pressure state in being hard to carry out mixture dispersion and rising to surface with air included in a detailed piece (H) of naturally-occurring-polymers system waste when mixing a detailed piece (H) of naturally-occurring-polymers system waste in liquid of a polyfunctional polyol ingredient (A), air will be removed and will become easy to perform mixture dispersion.

[0072]Since a detailed piece (H) of naturally-occurring-polymers system waste generally has hydrophilic nature, it contains humidity to some extent. Therefore, when mixture dispersion of the detailed piece (H) of naturally-occurring-polymers system waste is carried out into a polyfunctional polyol ingredient (A), moisture contained in a detailed piece (H) of naturally-occurring-polymers system waste will be carried in, and a moisture content in a polyfunctional polyol ingredient (A) will increase. Therefore, it is necessary to consider a moisture content carried in with a detailed piece (H) mixed amount of naturally-occurring-polymers system waste, and to control a moisture content of a polyfunctional polyol ingredient (A).

[0073]The regulator, the stabilizer, the colorant, an inflammable filler, and a diluting solvent of each ingredient are added by 2 liquid reacting cure type resin liquid (C). As stabilizer, a hindered phenol system and a hindered amine system antioxidant are used. As colorant, organic dye and carbon powder are effective. In a baking process, paints are not preferred in order to remain as ash. Addition of fire retardant should be avoided. As an inflammable filler, it is effective a hollow balloon or to reach and to make carbon powder contain 1 to 10%. It is a hollow resin balloon in true specific gravity of 0.15-0.50g/cc, and the lightweight differentiation end of 15-100 micrometers of \*\*\*\*\*. It is marketed under the name of UCAR Phenolic Microballoon (made in Union Carbide), and the Matsumoto microsphere (made by Matsumoto Yushi-Seiyaku). Making such hollow resin balloons contain will embed air on a resin model, it promotes decomposition, an outflow, and combustion in a delow process and a baking process, and an effect referred to as lessening remains ash reveals it. Content of a hollow resin balloon is 0.1 to 10 % of the weight to a resin model. If it becomes 10% of the weight or more, in ill-behaved \*\* and smooth mobility, reacting cure nature resin liquid (B) will become is hard to be obtained. Therefore, it is 3 to 8 % of the weight preferably.

[0074]This invention pursues what kind of resin composition is the optimal as a destruction-by-fire model used for precision casting, and advocates that resin composition within limited limits is effective as a destruction-by-fire model. Insufficient strength which is a fault of a low model

improves certainly by considering it as a resin model. If a resin model is not manufactured promptly, economical efficiency does not follow. Since it is not that to which a resin model is connected with mass production from the beginning, it is an industrialization overlay important point that a little resin models of other variety are promptly producible. Then, examination of resin composition as a destruction-by-fire model was repeated not into an injection method using a metallic mold and thermoplastics but into a field of reacting cure type resin which carries out flash set.

[0075]case resin hardened on the other hand is very hard -- warming -- melting decomposition spill combustion is overdue at the time of heating, and a problem of a mold breaking and causing breakage by expansion of resin is assumed. Therefore, it is required for the hardened whole resin model to become soft early, and to carry out stress distribution of the expansion stress of resin to the gate or an air extraction mouth. for this reason -- being alike -- hardness of 80 \*\* of a disappearance resin model which is a hardened material found out that 20-55 was the optimal by the Shore D hardness. It is 30-50 more preferably. expansion stress relaxation of hardening resin being bad, and being able to perform stress distribution to neither the gate nor an air extraction mouth, but expanding on a target on the other hand, and making a mold damage with the expansion force finally, if hardness of 80 \*\* becomes 55 or more by the Shore D hardness -- becoming . In a case of 20 or less, resin model hardness in temperature may become 40 or less by Shore D by the Shore D hardness summer, hardness of 80 \*\* may cause a shortage of hardness at an unmolding process at the time of resin model construction, and a resin model may change with impossible unmolding stress.

[0076]Thus, for setting out of resin composition for destruction-by-fire models, hardness, foaming control, etc. of a melting outflow combustion component and a hardened material of speed and a plasticizer component of quantity of resin, and a skeleton and hardening, or a low wax component involve mutually, the optimal adaptation range which maintained the balance was found out, and this invention was reached.

[0077]

[Example]First, the example of 2 liquid reacting cure type urethane resin liquid (C) is indicated below.

[0078](Example 1-resin liquid) To 3 Thu mouth KORUBEN, crewed MDI(NCO = 32%) 34.0 weight section, As a plasticizer, 14.0 weight sections and polypropylene-glycol (MW=200) 2.0 weight were taught, temperature up of the 2-ethylhexyl horse mackerel peat was gradually carried out after the uniformly stir dissolution, it stirred at 80 \*\* for 5 hours, the urethane-ized reaction was performed, and it was considered as the urethane prepolymer of the end NCO. NCO = it was 20.9%. 0.01 weight-section addition mixing of the defoaming agent was carried out, and it was considered as the polyfunctional polyisocyanate component at this.

[0079]To 4 Thu mouth KORUBEN, subsequently, ethylenediamine propylene oxide addition

(MW=300) 5.0 weight section and trimethylolpropanepropylene oxide addition (MW=400) 18.0 weight section, 100 \*\* carried out stirring mixing drying under vacuum for 1 hour, teaching 2-ethylhexyl horse mackerel peat 10.0 weight section as a plasticizer, and making nitrogen gas attract from a capillary tube. Moisture was 0.015% when moisture was measured by curl Fischer. After cooling, a little defoaming agent 0.01 weight sections, and octylic acid zinc / xylene solutions (10% solution) were added, and working life was adjusted in 3 minutes. As a low wax component, 5.0 weight sections of dense lows were added, and this was made into the polyfunctional polyol ingredient.

[0080]The compounding ratio of a polyfunctional polyol ingredient and a polyfunctional polyisocyanate component is 1:1 (weight). As for a calculated value, NCO/OH 0.88 and a plasticizer content 24.0 % of the weight, As for the content of a low wax component, the average functional group number of 3.43 and a polyfunctional polyisocyanate component of the average functional group number of a polyfunctional polyol ingredient is [ polyether chain content ] 2.33 10.0% of the weight 21.7% of the weight.

[0081](Comparative example 1-resin liquid) To 3 Thu mouth KORUBEN, crewed MDI(NCO = 32%) 43.0 weight section, As a plasticizer, 4.0 weight sections and polypropylene-glycol (MW=200) 2.0 weight were taught, gradual temperature up of the 2-ethylhexyl horse mackerel peat was carried out after the uniformly stir dissolution, it stirred at 80 \*\* for 5 hours, the urethane-ized reaction was performed, and it was considered as the urethane prepolymer of the end NCO. NCO = it was 25.0%. 0.01 weight-section addition mixing of the defoaming agent was carried out, and it was considered as the polyfunctional polyisocyanate component at this.

[0082]To 4 Thu mouth KORUBEN, subsequently, ethylenediamine propylene oxide addition (MW=300) 5.0 weight section and bisphenol propylene oxide addition (MW=400) 45.0 weight section, 100 \*\* carried out stirring mixing drying under vacuum for 1 hour, making nitrogen gas attract from a capillary tube. Moisture was 0.015% when moisture was measured by curl Fischer.

[0083]The compounding ratio of a polyfunctional polyol ingredient and a polyfunctional polyisocyanate component is 1:1 (weight). a calculated value -- as for the content of a low wax component, 1.02 and a plasticizer content is [ NCO/OH / polyether chain content / the average functional group number of 2.26 and a polyfunctional polyisocyanate component of the average functional group number of a polyfunctional polyol ingredient ] 2.32 0% of the weight 23.4% of the weight 5.0% of the weight.

[0084]

[Table 1]

2液反応硬化型ウレタン樹脂液 (C) の実施例及び比較例まとめ 表-1

組 成	実施例1ー樹脂	比較例1ー樹脂
エレンジアミン・プロピレンオキシド付加物 (mw=300) ★	5.0	5.0
エレンジアミン・プロピレンオキシド付加物 (mw=400) ★	7.0	—
トリメチロールプロパン・プロピレンオキシド付加物 (mw=400) ★	18.0	—
DOA	10.0	—
消泡剤	0.01	0.01
密ロウ	10.0	—
ビスフェノールPO付加物 (mw=400)	—	45.0
オクタル酸亜鉛	若干	若干
小計	50.01	50.01
グルーDMDI NCO=32%	34.0	43
ポリプロピレングリコール (mw=200) ★	2.0	2.0
DOA	14.0	5.0
消泡剤	0.01	0.01
小計	50.01	50.01
合計	100.02	100.02
2液配合比 (重量比)	1:1	1:1
NCO/OH	0.88	1.02
可使時間	3分	6分
樹脂含有量 (重量%)	66.0%	95.0%
可塑剤成分含有量 (重量%)	24.0%	5.0%
ロウ・ワックス成分含有量	10.0%	0.0%
アルキレンオキシド鎖含有量 (重量%)	21.7%	23.4%
ポリオール成分平均官能基数	3.43	2.26
ポリイソシアネート成分平均官能基数	2.33	2.32

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[0085](Example 2-resin liquid) As crewed MDI(NCO = 32%) 32.0 weight section and a plasticizer, 5.0 weight sections were taught for the 2-ethylhexyl horse mackerel peat, 8.0 weight sections were taught to 3 Thu mouth KORUBEN for xylene, and the uniformly stir dissolution was carried out. 5.0 weight sections of dense lows were added as a low wax component to this, and stirring mixing was carried out. NCO = it was 20.5%. This was made into the polyfunctional polyisocyanate component.

[0086]To 4 Thu mouth KORUBEN, subsequently, ethylenediamine propylene oxide addition (MW=300) 5.0 weight section, Ethylenediamine propylene oxide addition (MW=400) 7.0 weight section and trimethylolpropanepropylene oxide addition (MW=400) 16.0 weight section, Stirring mixing drying was carried out under vacuum for 100 \*\* 1 hour, teaching 2-ethylhexyl horse mackerel peat 5.0 weight section as a plasticizer, and making nitrogen gas attract from a capillary tube. Moisture was 0.02% when moisture was measured by curl Fischer.

[0087]7 weight-section addition mixing dilution of the xylene was carried out after cooling, a little octylic acid zinc / xylene solutions (10% solution) were added, and working life was adjusted to 90 seconds. As a low wax component, 5.0 weight sections of dense lows were added, and this was made into the polyfunctional polyol ingredient.

[0088]The compounding ratio of a polyfunctional polyol ingredient and a polyfunctional polyisocyanate component is 1:1 (weight). As for a calculated value, NCO/OH 0.88 and a

plasticizer content 10.0 % of the weight, As for the Low Wacks quantitative formula, the average functional group number of 3.40 and a polyfunctional polyisocyanate component of the average functional group number of a polyfunctional polyol ingredient is [ polyether chain content ] 2.37 13.0% of the weight 21.7% of the weight.

[0089](Comparative example 2-resin liquid) To 3 Thu mouth KORUBEN, crewed MDI(NCO = 32%) 36.0 weight section, As a plasticizer, 2.0 weight sections were carried out for the 2-ethylhexyl horse mackerel peat, gradual temperature up of 2.0 weight sections and the xylene 10 was carried out for the polypropylene glycol (mw=200) after weight section preparation and the uniformly stir dissolution, and it mixed at 80 °C for 1 hour. NCO = it was 20.5%. This was made into the polyfunctional polyisocyanate component.

[0090]To 4 Thu mouth KORUBEN, subsequently, ethylenediamine propylene oxide addition (MW=300) 5.0 weight section, And stirring mixing drying was carried out under vacuum for 100 °C 1 hour, teaching trimethylolpropanepropylene oxide addition (MW=400) 2.0 weight section and bisphenol propylene oxide addition 33.0 weight section, and making nitrogen gas attract from a capillary tube. Moisture was 0.02% when moisture was measured in curl Fischer.

[0091]10.0 weight-section addition mixing dilution of the xylene was carried out after cooling, a little octylic acid zinc / xylene solutions (10% solution) were added, and working life was adjusted in 3 minutes. This was made into the polyfunctional polyol ingredient.

[0092]The compounding ratio of a polyfunctional polyol ingredient and a polyfunctional polyisocyanate component is 1:1 (weight). a calculated value -- as for the Low Wacks quantitative formula, 1.03 and a plasticizer content is [ NCO/OH / polyether chain content / the average functional group number of 2.37 and a polyfunctional polyisocyanate component of the average functional group number of a polyfunctional polyol ingredient ] 2.33 0% of the weight 21.3% of the weight 2.0% of the weight.

[0093]

[Table 2]

2 液反応硬化型ウレタン樹脂液 (C) の実施例及び比較例まとめ 表-2

組 成	実施例 2-樹脂液	比較例 2-樹脂液
エレンジアミン・プロピレンオキサライド 付加物 (mw=300) ★	5.0	5.0
エレンジアミン・プロピレンオキサライド 付加物 (mw=400) ★	7.0	—
トリメチロールプロパン・プロピレンオキ サイド付加物 (mw=400) ★	16.0	2.0
DOA	5.0	—
消泡剤	0.01	0.01
密ロウ	8.0	—
ビスフェノールP付加物 (mw=400)	—	33.0
オクチル酸亜鉛	若干	若干
キシレン	9.0	10.0
小計	50.01	50.01
クルードMDI NCO=32%	32.0	36.0
ポリプロピレングリコールmw=200★	—	2.0
DOA	5.0	2.0
消泡剤	0.01	0.01
キシレン	8.0	10.0
密ロウ	5.0	—
小計	50.01	50.01
合計	100.02	100.02
2液配合比 (重量比)	1:1	1:1
NCO/OH	0.88	1.02
可使用時間	90秒	3分
樹脂含有量 (重量%)	66.0%	96.0%
可塑剤成分含有量 (重量%)	10.0%	2.0%
ロウ・ワックス成分含有量	13.0%	0.0%
アルキレンオキサライド鎖含有量 (重量%)	21.7%	23.4%
ポリオール成分平均官能基数	3.40	2.37
ポリイソシアネート成分平均官能基数	2.37	2.33

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[0094](Example 3-resin liquid) As crewed MDI(NCO = 32%) 32.0 weight section and a plasticizer, 5.0 weight sections were taught for the 2-ethylhexyl horse mackerel peat, 8.0 weight sections were taught to 3 Thu mouth KORUBEN for xylene, and the uniformly stir dissolution was carried out. 5.0 weight sections of dense lows were added as a low wax component to this, and stirring mixing was carried out. NCO = it was 20.5%. This was made into the polyfunctional polyisocyanate component.

[0095]To 4 Thu mouth KORUBEN, subsequently, ethylenediamine propylene oxide addition (MW=300) 7.0 weight section, Ethylenediamine propylene oxide addition (MW=400) 8.0 weight section and trimethylolpropanepropylene oxide addition (MW=400) 16.0 weight section, 100 \*\* carried out stirring mixing drying under vacuum for 1 hour, teaching 2-ethylhexyl horse mackerel peat 5.0 weight section as a plasticizer, and making nitrogen gas attract from a capillary tube. Moisture was 0.02% when moisture was measured by curl Fischer.

[0096]After cooling, 0.03 weight sections added and water was mixed homogenously for 1 hour. Subsequently, 9.0 weight-section addition mixing dilution of the xylene was carried out, a little octylic acid zinc / xylene solutions (10% solution) were added, and working life was adjusted in 2 minutes. As a low wax component, 5.0 weight sections of dense lows were

added, and this was made into the polyfunctional polyol ingredient.

[0097]The compounding ratio of a polyfunctional polyol ingredient and a polyfunctional polyisocyanate component is 1:1 (weight). As for a calculated value, NCO/OH 0.77 and a plasticizer content 10.0 % of the weight, As for the Low Wacks quantitative formula, the average functional group number of 3.30 and a polyfunctional polyisocyanate component of the average functional group number of a polyfunctional polyol ingredient is [ polyether chain content ] 2.30 10.0% of the weight 37.0% of the weight.

[0098](Comparative example 3-resin liquid) To 3 Thu mouth KORUBEN, crewed MDI(NCO = 32%) 36.0 weight section, As a plasticizer, 2.0 weight sections and a polypropylene glycol (mw=200) were taught for the 2-ethylhexyl horse mackerel peat, and ten weight sections were taught for 2.0 weight sections and xylene, and after the uniformly stir dissolution, gradual temperature up was carried out and it mixed at 80 \*\* for 1 hour. NCO = it was 20.5%. This was made into the polyfunctional polyisocyanate component.

[0099]To 4 Thu mouth KORUBEN, subsequently, ethylenediamine propylene oxide addition (MW=300) 5.0 weight section, And 100 \*\* carried out stirring mixing drying under vacuum for 1 hour, teaching trimethylolpropanepropylene oxide addition (MW=400) 2.0 weight section and bisphenol propylene oxide addition 33.0 weight section, and making nitrogen gas attract from a capillary tube. Moisture was 0.02% when moisture was measured by curl Fischer.

[0100]10.0 weight-section addition mixing dilution of the xylene was carried out after cooling, a little octylic acid zinc / xylene solutions (10% solution) were added, and working life was adjusted in 3 minutes. This was made into the polyfunctional polyol ingredient.

[0101]The compounding ratio of a polyfunctional polyol ingredient and a polyfunctional polyisocyanate component is 1:1 (weight). a calculated value -- as for the Low Wacks quantitative formula, 1.03 and a plasticizer content is [ NCO/OH / polyether chain content / the average functional group number of 2.37 and a polyfunctional polyisocyanate component of the average functional group number of a polyfunctional polyol ingredient ] 2.33 0% of the weight 21.3% of the weight 2.0% of the weight.

[0102]

[Table 3]

組 成	実施例3-樹脂液	比較例3-樹脂液
エレンジアミン・プロピレンオキサイド 付加物 (mw=300) ★	7.0	5.0
エレンジアミン・プロピレンオキサイド 付加物 (mw=400) ★	8.0	—
トリメチロールプロパン・プロピレンオキ サイド付加物 (mw=400) ★	16.0	2.0
DOA	5.0	—
紫泡剤	0.01	0.01
密ロウ	5.0	—
ビスフェノールPO付加物 (mw=400)	—	33.0
オクチル酸亜鉛	若干	若干
キシレン	9.0	10.0
水	0.03	—
小計	50.04	50.01
クルードMDI NCO=32%	32.0	36.0
ポリプロピレングリコールmw=200 ★	—	2.0
DOA	5.0	2.0
キシレン	8.0	10.0
密ロウ	5.0	0.0
小計	50.0	50.01
合計	100.04	100.02
2液配合比 (重量比)	1:1	1:1
NCO/OH	0.82	1.03
可使用時間	2分	3分
樹脂含有量 (重量%)	66.0%	96.0%
可塑剤成分含有量 (重量%)	10.0%	2.0%
ロウ・ワックス成分含有量	10.0%	0.0%
アルキレンオキサイド鎖含有量 (重量%)	21.0%	21.3%
ポリオール成分平均官能基数	3.30	2.37
ポリイソシアネート成分平均官能基数	2.30	2.33

★印 アルキレンオキサイド含有化合物

添加した水分は官能基数2.0として計算した。

[0103](Example 4-resin liquid) As crewed MDI(NCO = 32%) 32.0 weight section and a plasticizer, 5.0 weight sections were taught for the 2-ethylhexyl horse mackerel peat, 8.0 weight sections were taught to 3 Thu mouth KORUBEN for xylene, and the uniformly stir dissolution was carried out. 5.0 weight sections of dense lows were added as a low wax component to this, and stirring mixing was carried out. NCO = it was 20.5%. This was made into the polyfunctional polyisocyanate component.

[0104]To 4 Thu mouth KORUBEN, subsequently, ethylenediamine propylene oxide addition (MW=300) 7.0 weight section, Ethylenediamine propylene oxide addition (MW=400) 8.0 weight section and trimethylolpropanepropylene oxide addition (MW=400) 16.0 weight section, 100 \*\* carried out stirring mixing drying under vacuum for 1 hour, teaching 2-ethylhexyl horse mackerel peat 3.0 weight section as a plasticizer, and making nitrogen gas attract from a capillary tube. Moisture was 0.02% when moisture was measured by curl Fischer.

[0105]9.0 weight-section addition mixing dilution of the xylene was carried out after cooling, a little octylic acid zinc / xylene solutions (10% solution) were added, and working life was adjusted in 3 minutes. As a low wax component, 5.0 weight sections and sawdust (wood cutting powder by which it is generated at time of wood cutting) 2.0 weight section of 10 % of

the weight of moisture contents were added for the dense low, and this was made into the polyfunctional polyol ingredient.

[0106]The compounding ratio of a polyfunctional polyol ingredient and a polyfunctional polyisocyanate component is 1:1 (weight). a calculated value -- as for the Low Wacks quantitative formula, 0.83 and a plasticizer content is [ NCO/OH / polyether chain content / the average functional group number of 3.30 and a polyfunctional polyisocyanate component of the average functional group number of a polyfunctional polyol ingredient ] 2.30 10.0% of the weight 21.0% of the weight 8.0% of the weight.

[0107](Comparative example 4-resin liquid) 8.0 weight sections were taught to 3 Thu mouth KORUBEN, gradual temperature up of crewed MDI(NCO = 32%) 42.0 weight section and the xylene was carried out to it after the uniformly stir dissolution, and it mixed at 80 °C for 1 hour. NCO = it was 26.9%. This was made into the polyfunctional polyisocyanate component.

[0108]To 4 Thu mouth KORUBEN, subsequently, ethylenediamine propylene oxide addition (MW=300) 5.0 weight section, And 100 °C carried out stirring mixing drying under vacuum for 1 hour, teaching trimethylolpropanepropylene oxide addition (MW=400) 3.5 weight section and bisphenol propylene oxide addition 30.0 weight section, and making nitrogen gas attract from a capillary tube. Water 1.5 weight-section addition was carried out, and stirring mixing was carried out for 1 hour. Moisture was 3.02% when moisture was measured by curl Fischer.

[0109]8.0 weight-section addition mixing dilution of the xylene was carried out after cooling, a little octylic acid zinc / xylene solutions (10% solution) were added, and working life was adjusted in 3 minutes. This was made into the polyfunctional polyol ingredient.

[0110]The compounding ratio of a polyfunctional polyol ingredient and a polyfunctional polyisocyanate component is 1:1 (weight). a calculated value -- as for the Low Wacks quantitative formula, 0.78 and a plasticizer content is [ NCO/OH / polyether chain content / the average functional group number of 2.24 and a polyfunctional polyisocyanate component of the average functional group number of a polyfunctional polyol ingredient ] 2.20 0% of the weight 21.3% of the weight 0.0% of the weight.

[0111]

[Table 4]

2 液反応硬化型ウレタン樹脂液の実施例及び比較例まとめ 表-4

組 成	実施例 4-樹脂液	比較例 4-樹脂液
エレンジアミン・プロピレンオキサイド 付加物 (mw=300) ★	7.0	5.0
エレンジアミン・プロピレンオキサイド 付加物 (mw=400) ★	8.0	—
トリメチロールプロパン・プロピレンオキ サイド付加物 (mw=400) ★	16.0	3.5
DOA	3.0	—
密泡剤	0.01	0.01
密ロウ	5.0	—
ビスフェノール P O 付加物 (mw=400)	—	30.0
オクテリル酸亜鉛	若干	若干
キシレン	9.0	10.0
水	—	1.5
おがくず (水分 10% 含有)	2.0	—
小計	50.01	50.01
グルー FMDI NCO=32%	32.0	42.0
ポリプロピレングリコール mw=200 ★	—	0.0
DOA	5.0	0.0
キシレン	8.0	8.0
密ロウ	5.0	0.0
小計	50.0	50.0
合計	100.01	100.01
2 液配合比 (重量比)	1:1	1:1
NCO/OH	0.77	0.78
可使用時間	3 分	3 分
樹脂含有量 (重量%)	66.0%	82.0%
可塑剤成分含有量 (重量%)	8.0%	0.0%
ロウ・ワックス成分含有量	10.0%	0.0%
アルキレンオキサイド鎖含有量 (重量%)	21.0%	21.3%
ポリオール成分平均官能基数	3.30	2.24
ポリイソシアネート成分平均官能基数	2.30	2.30

★印 アルキレンオキサイド含有化合物

添加した水分は官能基数 2.0 として計算した。

[0112]Subsequently, the example of the resin model using these 2 liquid reacting cure type urethane resin liquid (C) and a comparative example are shown below.

[0113]Models are autoparts and are the total model weight of 0.8 kg, 25 mm of thick parts, 0.4 mm of closing-in parts, 200 mm of the vertical longest parts, 300 mm of the horizontal longest parts, and 200 mm of the height longest parts. On the whole, complicated shape was presented, since there was no draft, it was reversed from the master model to the silicone rubber type, and the model was manufactured in vacuum casting.

[0114]A master model is created by the method of carrying out the following. That is, by preparing photoresist acrylic resin liquid in the resin receiving container of a Mitsuzo form machine, and carrying out slight quantity descent of the supporting stage which was installed in the resin receiving container and which can be gone up and down from a resin liquid side, resin liquid is supplied on a supporting stage and the thin layer is formed. Subsequently, the cured resin layer of a solid state is formed by irradiating with the light by which computer control was carried out based on the formed data of the resin model which should be modeled to this thin layer. Subsequently, by supplying reacting cure nature resin liquid on this cured

resin layer, making a thin layer form further, and irradiating with the light by which computer control was carried out to this thin layer, a new cured resin layer is formed so that this may be followed on said cured resin layer and it may laminate in one. And changing the pattern in which an optical exposure is carried out by computer control, without making it change, by the number of predetermined times repeating this process, two or more cured resin layers are laminated in one, and a resin model is modeled as a solid three-dimensional shaped object. Thus, the resin model modeled in the shape of a solid three dimension is separated and taken out from the supporting stage of a receiving container. Washing removal of the unreacted resin liquid which remains on the surface of a resin model is carried out by an organic solvent. As this organic solvent for washing, there are isopropyl alcohol, ethyl alcohol, acetone, ethyl acetate, methyl ethyl ketone, etc. Then, complete cure of the post cure is further performed and carried out by optical exposure. And the barricade overflowing into the side of the hardening resin model is diminished by a cutter, and dropping finishing is performed. There were no bleeding and tuck of a plasticizer in the surface of the resin model formed by this, and it became a normal model on it. This resin liquid was momentarily hardened by the optical exposure. The hardness of the hardening resin model was 75 by the Shore D hardness.

[0115]The reversal from a master model to a silicon type is as follows. A gate and a casting mouth are determined, the gate of a plastic bar is joined to a master model, a temporary stop is carried out into a container, and release agent processing is performed. Transparent RTV silicon resin liquid (Shin-etsu chemicals KE1606) and hardening agent resin liquid (Shin-etsu chemicals CAT-RG) It takes out to a mixing vessel by 20:1, It puts into a vacuum defoaming tank after mixing with an agitator, a vacua and a deaeration leak state are repeated several times, foam breaking of the mixed air bubbles which came floating to the resin liquid surface is carried out, and it defoams. Subsequently, mixed transparent RTV silicon resin liquid is slowly slushed into the container which carried out the temporary stop of a master model and the gate. In order to carry out foam breaking of the air bubbles at the time of casting thoroughly, it put into the vacuum chamber again, and in the reduced pressure state, it held for 10 minutes and defoamed. And it takes out from a vacuum chamber, room temperature setting is carried out one whole day and night, and the hardened material of the transparent RTV silicon which included the master model is obtained. Targeting the particle line which described this transparent silicon in the master model, a knife cuts a transparent silicon hardened material to 2 types, and a master model is taken out. A cutter cuts the tip part of a gate and it is considered as a casting mouth. On the other hand, in order to create an air extraction mouth, the V cut of the transparent silicon type is carried out with a knife. In this way, the transparent silicon rate type which has a casting mouth and an air extraction mouth in the upper part is created. and -- setting a rate type correctly along with a positioning boss, and fixing firmly on a tape -- a casting mouth -- a plastic -- a funnel is inserted, and it fixes and is considered as the

saucer of casting resin liquid.

[0116]Each method which carried out model construction is as follows in the resin liquid of an example and a comparative example to vacuum casting. Install a silicon type in a vacuum chamber, a polyfunctional polyol ingredient (A) is made two set containers, 50-copy weighing of the polyfunctional polyisocyanate component (B) is carried out to another [ 50 copies and ] container, and it sets. A vacuum chamber is made decompression, this container is leaned by rotating the knob for rotation drawn out of the vacuum chamber from the container set into which the polyfunctional polyol ingredient (A) in a vacuum chamber was subsequently put, and a polyfunctional polyol ingredient (A) is slushed into the container containing a polyfunctional polyisocyanate component (B). The stirring rod immediately attached to the container containing a polyfunctional polyisocyanate component (B) after that is rotated, and 2 liquid is mixed. the plastic fixed to the transparent RTV silicon type casting mouth by rotating the knob for rotation drawn out of the vacuum chamber from this 2 liquid-mixture container -- two liquid mixtures are slushed into a funnel. Two liquid mixtures are slushed into the model shaped space part of transparent RTV silicon by this. And the vacuum of a vacuum chamber is broken promptly and the inside of a vacuum chamber is returned to ordinary pressure. The work so far is done with sufficient \*\*\*\*\*, and it ends within about 40 seconds.

[0117]The example and comparative example of a resin model are collectively shown in table-5.

[0118]

[Table 5]

模型実施例及び比較例 まとめ

表-5

	比較項目	実施例1－ 模型	比較例1－ 模型	実施例2－ 模型	比較例2－ 模型
使用樹脂	樹脂液	実施例1－ 樹脂液	比較例1－ 樹脂液	実施例2－ 樹脂液	比較例2－ 樹脂液
	硬化タイプ	2液硬化	2液硬化	2液硬化	2液硬化
	可使用時間	3分	6分	90秒	3分
作業性	液温	20℃	20℃	20℃	20℃
	型温	20℃	20℃	20℃	20℃
	脱型可能時間	2時間	翌日	30分	12時間
	後硬化条件	20℃1日	20℃1日	20℃1日	20℃1日
	成形工法	真空注型	真空注型	真空注型	真空注型
硬化模型	硬化物外觀	OK	OK	OK	OK
	タック	OK	OK	OK	有り
	形状保持	OK	OK	OK	OK
	発泡	OK	OK	OK	OK
	シャープ性	OK	OK	OK	OK
	リップ立ち性	OK	OK	OK	OK
	割れ	OK	OK	OK	OK

OKは「問題なし」であることを示す。

[0119]

[Table 6]

模型実施例及び比較例 まとめ

表-6

	比較例項目	実施例 3 - 模型	比較例 3 - 模型	実施例 4 - 模型	比較例 4 - 模型
使用樹脂	樹脂液	実施例 3 - 樹脂液	比較例 3 - 樹脂液	実施例 4 - 樹脂液	比較例 4 - 樹脂液
	硬化タイプ	2液硬化	2液硬化	2液硬化	2液硬化
	可成時間	2分	3分	3分	3分
作業性	液温	20℃	20℃	20℃	20℃
	型温	20℃	20℃	20℃	20℃
	成型可能時間	60分	12時間	30分	60分
	後硬化条件	20℃1日	20℃1日	20℃1日	20℃1日
	成形工法	真空注型	真空注型	真空注型	真空注型
硬化模型	硬化物外観	OK	OK	OK	OK
	タック	OK	ややあり	OK	有り
	形状保持	OK	OK	OK	ボイド発生
	発泡	微発泡でOK	OK	微発泡でOK	発泡大*
	シャープ性	OK	OK	OK	OK
	リブ立ち性	OK	OK	OK	OK
	割れ	OK	OK	OK	OK

\*発泡大きく、肉薄部位は極薄表皮層／内部空隙となり、正常な形状保持は困難である。

OKは、「問題なし」であることを示す。

[0120]The precision casting process condition by the resin model using the reacting cure nature resin liquid of this invention and a casting example, and a comparative example are indicated.

[0121]The precision casting process after model construction is as follows.

[0122]1. Model preparation : join the gate which consists of loss TOWAKKU to a resin model.

[0123]2. -- coating: -- zirconia -- sol -- it is immersed in the slurry which comprises - electromelting zirconia, electromelting zirconia is sprinkled as a stucco grain, and it dries for 3 hours, and is considered as a first layer. Subsequently, it is immersed in the slurry which comprises colloidal silica mullite, fused silica is sprinkled as a stucco grain, and it is made to dry for 2 hours. Repetition coating is ended for this operation 10 times.

[0124]3. Delow : guess a hot wind with a dryer to the gate of the coated resin model, and heat to it for about 1 hour. The delow of the ROSUTO wax part is carried out, and thermal decomposition / liquefaction spill of a resin model is urged.

[0125]4. 1st calcination: After a delow, install in a gas furnace, hold at temperature up and 200 \*\* gradually for 30 minutes, and urge thermal decomposition and combustion of a resin model. Temperature up is carried out gradually, it holds at 550 \*\* for 60 minutes, and combustion disappearance of a resin model is performed. Temperature up is carried out gradually and it is considered as strengthening of the perfect combustion and mold of a resin model at 1100 \*\*.

[0126]5.2nd calcination: After removing ash inside a mold, install in an electric furnace, calcinate at 850 \*\* for 1 hour, and remove free moisture of a mold.

[0127]6. Melt metal : dissolve 6-Ti-4 alloy under an argon gas air current in the fusion furnace of a vacuum melting casting furnace. Dissolution temperature is 1700 \*\*.

[0128]7. Cast : perform cast promptly after the Ti alloy dissolution. After casting and in a furnace, it cools slowly.

[0129]8. Shake out : take a mold into pieces with a hammer, take out a casting, and shot blasting and sandblasting remove adhesion remains refractories after cutting a runner.

[0130]Visual inspection: Visually, check the sharpness, closing-in part rib \*\*\*\*, etc. of void generating and the edge of cast appearance shape and surface.

[0131]The example and comparative example of precision casting by the resin model using reacting cure nature resin liquid are summarized in Tables 7-8, and it indicates below.

[0132]

[Table 7]

樹脂模型を用いた精密鑄造の実施例と比較例

表-7

鑄造実施例比較例No		実施例1ー 鑄 造	比較例1ー 鑄 造	実施例2ー 鑄 造	比較例2ー 鑄 造
模型実施例比較例No		実施例1ー 模 型	比較例1ー 模 型	実施例2ー 模 型	比較例2ー 模 型
鋅 型	鋅型ヘヤークラック 発生	OK	ヘヤークラ ック発生	OK	ヘヤークラ ック発生
	鋅型割れ発生	OK	OK	OK	発生
鋅 物	鋅物外形形状	OK	やや変形	OK	やや変形
	鋅物表面のポイド	OK	有り	OK	OK
	鋅物肉薄部位の欠損	OK	少々	OK	OK

OKは、「問題なし」であることを示す。

[0133]

[Table 8]

樹脂模型を用いた精密鋳造の実施例と比較例 表-8

鋳造実施例比較例No		実施例-3 鋳 造	比較例-3 鋳 造	実施例-4 鋳 造	比較例-4 鋳 造
模型実施例比較例No		実施例-3 模 型	比較例-3 模 型	実施例-4 模 型	比較例-4 模 型
鋳 型	鋳型ヘヤークラック発 生	OK	発生	OK	少々
	鋳型割れ発生	OK	発生	OK	OK
鋳 物	鋳物外形形状	OK	変形	OK	やや変形
	鋳物表面のポイド	OK	OK	OK	あり
	鋳物肉薄部位の欠損	OK	OK	OK	あり

OKは、「問題なし」であることを示す。

[0134]

[Effect of the Invention]in the precision casting by a lost wax process, when it has a part with a thickness of 1 mm or less, carry out the low model used as a sublimation pattern for cutting by Low Wacks's insufficient strength -- carry out for carrying out injection molding to a metallic mold -- manufacture is difficult. According to this invention, a model with a thickness of 0.5 mm can be manufactured easily. that is, -- in this invention, production of closing-in precision casting parts is very attained -- precision casting parts, such as a camera, a clock, shaving and a cellular phone, autoparts, and airplane parts, -- the big effect referred to as broadly adapted is revealed.

[0135]If careful attention is not paid to the handling in the case of the low model which has the thickness of about 1 mm, it will be easy to damage a closing-in part, and will bend - Be easy to break, but the resin model of this invention excels [ elasticity / intensity and ] the low model in whether you are Haruka.

[0136]Especially, when 1,000 pieces, 10,000 pieces, and a number increased, even if the amount of burst sizes paid careful attention, it had become very difficult work by the conventional low model, but. Since the intensity and the elasticity of the model itself are far excellent if it depends with the resin model of this invention, there is an effect said that the handling of a model becomes very easy for a precision casting contractor.

[0137]Although the low model cannot take out sharp edge easily, since the model surface was covered by resin and the low ingredient is buried in the resin skeleton, the resin model concerning this invention can take out beautiful sharp edge. Thus, in order that diversity may appear in the shape of a model by considering it as the resin model which made resin the skeleton, an absolute predominance is among the thin matters which carried out complicated shape.

[0138]At the temperature of midsummer, since the conventional low model had the high danger that shape will collapse, it needed to be saved in the thermostatic chamber, but. Since it has hardness sufficient also at the temperature of midsummer for shape maintenance when it is the resin model by which the low ingredient was buried in the resin skeleton concerning this invention, there is an effect said that severe management for fire it must save in a thermostatic chamber is unnecessary.

[0139]On the resin model concerning this invention, the plasticizer component contains so much further again.

At a delow and a baking process, it decomposes, and is easy to flow out and a mold does not break [ melting and ].

This effect demonstrates validity increasingly from the low wax component being added. Since it becomes a fine foamed resin model by carrying out moisture addition, the effect is unfathomable.

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[Translation done.]